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EDITORIAL

PHARMACY AND THE COMMITTEE ON ECONOMIC SECURITY

IN AN editorial appearing in the current issue (November 19th) of the *Journal of the American Medical Association,* that efficient and wideawake body expresses in veiled terms its conviction of the fact that socialized medicine of a sort *will be* one of the first experiments of the New Deal.

It seems to admit that any device now used in an attempt to stem this tendency of the forces in Washington would be "as futile as a damp match."

Yet the last paragraph of the editorial pronounces in no uncertain terms—and properly so—that organized medicine shall have in this whole matter, if not its way, at least its *certain* say.

"Presumably there will eventually be proposed legislation on which hearings will be held by Congress in the usual manner. Physicians should be aware of the various phases of this matter. The various bureaus and officers of the Association, including the Board of Trustees, are in intimate touch with the activities now under way and are doing their best to make certain that the point of view of organized medicine is adequately presented."

And what is organized pharmacy doing about it—assuming that something should be done to "first conserve the people's interests"—and afterwards the interests of those who find and make and mix the potent drugs used in the healing sciences?

But read the rest of the editorial to which we refer and note that pharmacy is as yet without representation or mention.

"Last June, as was pointed out in a previous editorial in THE JOURNAL (1), President Roosevelt created a committee on economic

[1] The Administration Studies Social Insurance, editorial, J. A. M. A. *103:* 609 (Aug. 25) 1934.

security to look into plans and advise prospective legislation that will provide people with decent homes and productive work and 'safeguard them against misfortunes which cannot be wholly eliminated in this man-made world of ours.' The committee included the Secretaries of Labor, the Treasury and Agriculture, the Attorney-General and the Federal Emergency Relief Administrator. This committee established a staff and selected as secretary and executive director Edwin E. Witte, a labor economist long associated with the industrial commission of the state of Wisconsin. The committee set up a technical board of twenty persons in the government service with special knowledge of various phases of economic security and also established a staff of specialists to look into different aspects of the subject.

"In a bulletin for the press, just issued, it is pointed out that there is contemplated an advisory council to be named by the President. This council is to be composed of representative citizens who will advise on broad general policies. A special medical advisory committee is also to be appointed. In its first bulletin the Committee on Economic Security said, 'Following the approach outlined by the President, the Committee is trying to draw up a comprehensive program which will give protection to the individual from all the vicissitudes and hazards of modern life—unemployment, accident, sickness, invalidity, old age and premature death.' The report of the committee is due to be made to the President on December 1 and will not be made public until released by the President.

"Following the publication of the editorial that appeared in THE JOURNAL, a statement was received from Miss Perkins to the effect that a group of distinguished physicians would be constituted as an advisory board in the field of medicine. In a recent statement Miss Perkins announces that the medical advisory committee will consist of eleven eminent physicians and surgeons from all parts of the country, including the presidents of the three principal national organizations. Other advisory committees are to be created in dentistry, hospital management and public health."

And this is just the place to repeat the question:

"What is organized pharmacy doing about it?"

IVOR GRIFFITH.

ORIGINAL ARTICLES

ALCHEMICAL SYMBOLS AS USED IN PHARMACY

By Charles H. LaWall

Presented at the November meeting of the Washington-Baltimore Section of the History of Science Society, Wednesday, November 7, 1934, at the American Institute of Pharmacy.

THE use of symbols was part of the esoteric knowledge of chemistry for many centuries. It served two useful purposes. It afforded an opportunity for much needed secrecy and it saved time and space in the tedious and extensive recording of results in the period prior to printing, but even after printing began it was customary for authors of important works in pharmacy and chemistry to include lists of these symbols, with their accompanying translations for the information of their readers, for by the sixteenth century writers on pharmaceutical subjects were using symbols almost as freely as writers upon chemical subjects. Now, one who has never studied the subject at all would think that this would be a very simple subject to comprehend. All that would have to be done would be to learn the symbols for the various substances, the shorthand of the profession, as it were, and then one might read these ancient manuscripts and printed books, in which the symbols were used, with facility; but it is not as simple as this. Researches which have been devoted to the subject and collections of symbols that have been classified and studied, show that there were many authors who devised systems of their own, and inasmuch as there was no common or basic plan the result is chaotic. When one searches in the general literature for anything bearing upon the subject the result is disappointment. The interesting and valuable book of Donald A. Mackenzie on the "Migration of Symbols" is concerned only with the swastika, the spiral, the ear symbols, and the tree symbols. Harold Bayley, in his two volume work on "The Lost Language of Symbolism," discusses only the symbolism of printers' "water marks," which, as he shows, are largely of religious origin. He pays no attention whatever to the symbols used in the arts, crafts, trades and professions. Dr. Lynn Thorndyke, in his "History of Magic and Experimental Research," has a few references to symbolism in

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No. 1. Index of Alchemistic Symbols, from "Alchemistische und Chemische Zeichen, Dr. F. Lüdy, 1928. There are 127 tables in this Compilation, totalling nearly 4000 Symbols.

alchemy, but they are concerned with language symbolism rather than with actual specific symbols such as we are now discussing. Two volumes which have thus far appeared of Sarton's "Introduction to the History of Science" bring us up to the time of Roger Bacon in the twelfth century. There are references in this work to the theological symbols used by Hildegarde of Bingen and to the algebraic symbols employed by Lully, and to the "Decknamen" or substitute names employed for insuring alchemical secrecy, but the only alchemical symbols referred to are the signs for the seven metals, which are not reproduced.

The ancient Greek and Syriac manuscripts which are in the British Museum contain examples of the use of such symbols as we are discussing. The Arabians did not use symbols during their dominant period. They appeared freely in printed books beginning with the sixteenth century. Special studies and illustrated tables have been published since early in the eighteenth century, while lists and examples of the symbols themselves are found frequently in both chemical and pharmaceutical works of the sixteenth and seventeenth centuries. It is not my purpose to review this subject as a whole, for that was excellently done in 1928 by Dr. Lüdy, Jr., of Burgdorf, Switzerland, whose work was published by "Der Gesellschaft für Geschichte der Pharmazie." In this work Dr. Lüdy not only summarizes the history of the subject very capably, but includes 127 tables in which all of the symbols he has been able to find are ingeniously classified and indexed according to geometric forms.

In this work Lüdy traces the history of the use of symbols from the earliest alchemistic manuscripts to the extensive use which was made of them in the labeling of pharmacy jars and bottles in the eighteenth century. One of the earliest instances of the pharmaceutical appropriation of these alchemistic signs is given by Lüdy in the reproduction of a page from the Pharmacopœia of Cologne, 1628, in which nearly 100 of these symbols are shown. He also gives a number of interesting photographs of pharmaceutical containers illustrating the employment of these symbols in effecting a condensation of the labels of many different classes of pharmaceutical preparations. It is interesting for us to remember that certain important symbols have come down to us from ancient times with little or no change. Take, for example, the symbols for the four

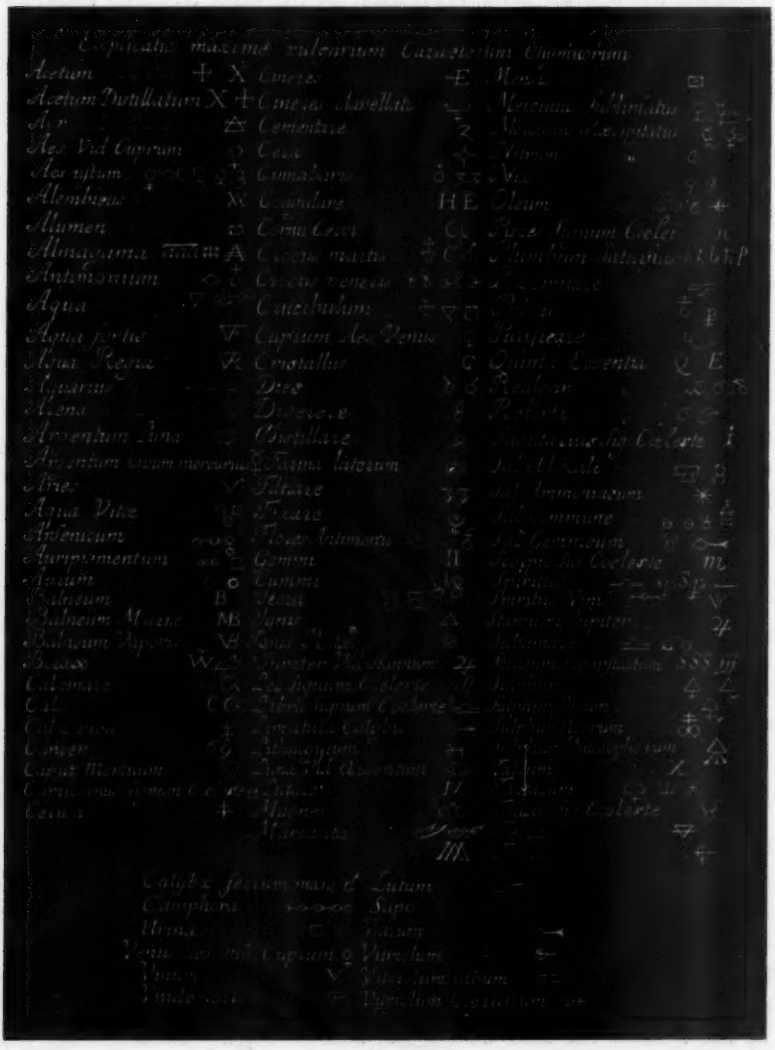
	Fusio		Antimonii regulus
	Fusio		Tigillum
	Tartarus		Tigillum
	Jupiter		Tigillum
	Jupiter		Marcasita, Nitrum commune
	Aqua fortis		Essentia
	Stannum, Jupiter		Mercurius vivus
	Bezoardicum ioviale		Mercurius vivus
	Bezoardicum ioviale		Aqua vitae
	Marcasita		Mercurius vivus
	Ferrum		Vitriolum
	Pars cum parte		Siehe bei ∪
	Aqua fortis		Nitrum commune
	Quinta essentia  Lixivium		Sal gemmae
	Scrupulus		Nitrum commune

No. 2. Example of Table No. 46, from Alchemistische und Chemische Zeichen. Dr. F. Lüdy, 1928. Upon this page will be found the commonly used sign for Jupiter; also similar symbols with diverse meanings.

hypothetical elements of Democritus and Empodocles: earth, air, fire and water. Water and earth are represented by inverted isosceles triangles, fire and air being representd by the same triangles standing on their respective bases. Earth and air are distinguished from their otherwise identical counterparts by having a horizontal line drawn through them about half way up. Here is obvious evidence of an attempt to show certain fundamental realtionships—similarities and contrasts, as it were—and yet out of these four symbols associated with the properties of heat, cold, moisture and dryness, there was evolved a complicated system called "the doctrine of the humors," which was in use in Galen's time, and which hampered medicine for so many centuries thereafter, and whose influence we still respect in the daily use of the terms "phlegmatic, choleric, sanguine and melancholic." It is interesting also to note that in addition to the triangle, another symbol was used for water in ancient Egypt. This was a pair of wavy or jagged lines supposed to resemble ripples, and this was taken over by the Phoenicians as the letter "M." The word "em" is the Hebrew for water. This pair of wavy or jagged lines appears in the list of chemical and pharmaceutical symbols as one of the alternative symbols for water.

While it is true that there are many variants and also many distinctive different symbols for the same elements, there are certain predominant forms, especially for the important seven metals of the ancients which have come down to us with interesting explanations for the particular form of each. In the symbol for gold we see the outline of the sun, sometimes with rays, sometimes without. In the symbol for silver we find the crescent moon, and in pharmacy we still call silver nitrate "lunar caustic." For copper, the sign of Venus, the governing planet, is used, and the symbol is said to be the mirror of that deity, with its handle sticking out below. For iron we are told that the symbol is that of the shield and spear of Mars, the god of war, and Crocus Martis is an old name for oxide of iron. In the symbol for Mercury, we recognize the wings and the double serpent adorned staff wrongly called the "caduceus"—misused by the Medical Corps of the United States Army as such. In the symbol for lead we see the seat of mighty Saturn, once the head of the Olympian gods, deposed by his son Jupiter, whose thunderbolt is the symbol for tin, this metal having been assigned to his protection.

All of this is pure speculation and some of it is unquestionably incorrect, as has been shown by J. Hampton Hoch in his excellent



No. 3. Page illustrating the appropriation of the symbols of Alchemy by pharmaceutical Authority. From the Pharmacopoea Regia-Chymica, Moses Charas, Geneva, MD. CLXXXIV. In this table will be found symbols for the four supposed original elements—earth, air, fire and water. Also symbols for periods of time, such as hour, day, night, month, etc.

article on alchemistic symbols in the Journal of the American Pharmaceutical Association for May, 1934, page 431.

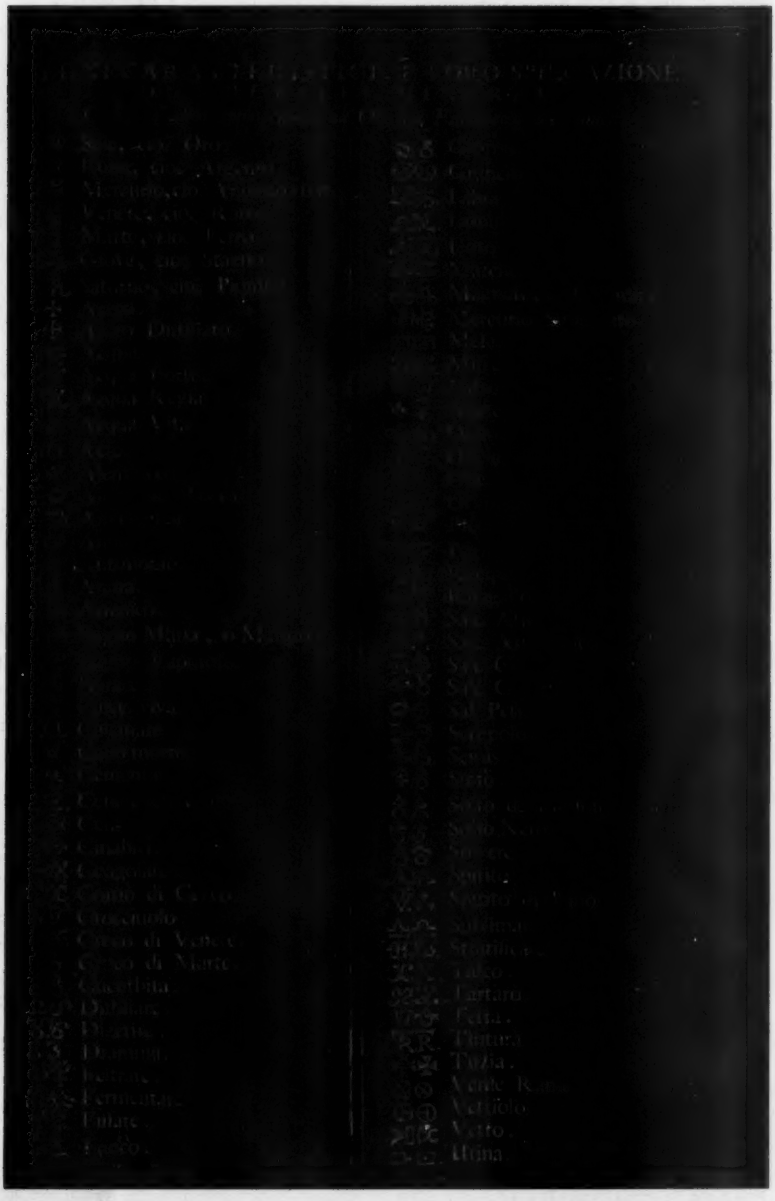
We sometimes overlook the fact that we still pay verbal tribute to these ancient beliefs in our everyday use of such words as "jovial, saturnine, mercurial, venereal, martial and lunatic," all of which are derived from the early names of the seven heavenly bodies which we are discussing.

But our ancient brothers of the craft were not satisfied with these classic symbolic forms; they must add to them, duplicate and confuse them until the result was chaotic. In the early eighteenth century there was anonymously published a work called a "Medicinal Chemical, and Alchemistic Oracle," in which were assembled hundreds of these symbols, some of which had been in use for centuries. The great Johann Christopher Somerhoff, an apothecary in Hanover, had previously published in Nüremberg a "Pharmaceutico-Chymicum Lexicon" in which there was an alphabetical arrangement of subjects with a list of all the symbols which had been used for each particular substance. Both of these works are commented upon by Lüdy and illustrations of pages from them are given.

In looking over some of the chemical and pharmaceutical works in my own library, I was particularly interested in the symbols given by Oswald Crollius in his "Basilica Chymica" published in 1643, in which occasionally three variants are given, and sometimes as high as six for the same substance. One of the most complete lists of symbols that I have found in a pharmaceutical work is in the Nuovo et Universale Theatro Farmaceutico, by Antonio Sgobbis (1667). More than 100 titles are arranged alphabetically with the symbol or symbols used for each, the duplications frequently running to four, five or six different forms.

In the "Pharmacopœa Regia Chymica" of Moses Charas, published in 1656 in French, a list of titles and symbols is given in beautiful copperplate page form, which list I find to be absolutely duplicated, with some of its errors, in the eleventh edition of the "Cours de Chymie" by Nicholas Lemery, published in 1716. A very complete list of titles and symbols, without more than one or two variants is given in the "Pharmacopœia Medico-Chymica" by Johannes Schroeder, published in 1655.

The English authors of pharmaceutical and chemical works did not, as a rule, make use of the symbols nor even publish lists of



No. 4. Page illustrating the appropriation of the symbols of Alchemy by a pharmaceutical authority. From the Teatro Farmaceutico Dogmatico e Spagirico del dottor Giuseppe Donzelli. In Venezia, MDCCXXVIII. Note too, that some of the symbols differ materially from those given in Illustration No. 3.

them. I have found brief lists of what are called "medicinal characters," in several of the works of William Salmon, who had the effrontery to entitle his principal book "Pharmacopœis Londinensis," and whose works were published in the latter part of the seventeenth century. But the English made up for their deficiencies in this respect when Dr. George Bates, of the London College of Physicians, published a book in 1690 which is usually called "Pharmacopœia Bateana." This is the most outstanding example of the use of symbols in a pharmaceutical work. In Bates' Pharmacopœia he starts off with two pages of titles and symbols and then uses these symbols throughout the work, thus saving space in the text. It makes an unintelligible page for the average reader of such books unless the table at the front of the book is consulted. The most interesting examples, however, I think, which are to be found, of the pharmaceutical employment of alchemistic symbols are in connection with the labeling of jars and bottles.

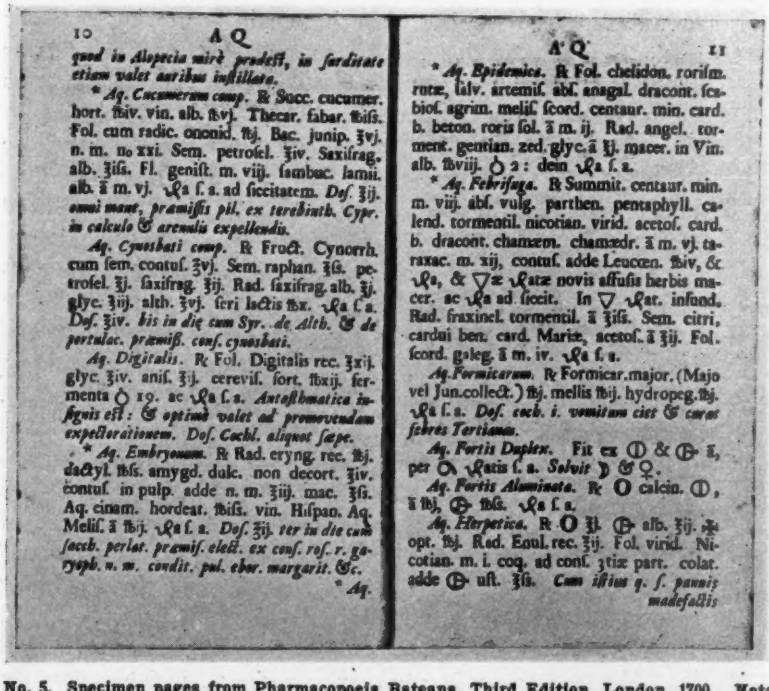
There are a large number of such containers bearing symbolic labels in the Squibb collection of pharmaceutical antiques which was exhibited at the Chicago Exposition in 1933, but which has not as yet been put on permanent display.

There are two unsolved problems in connection with the use of symbols which are distinctly pharmaceutical in their origin. One of these is concerned with the use of the sign of Jupiter at the head of formulas or prescriptions, which is said to have originated shortly after the beginning of the Christian era, and which we know continued until the end of the eighteenth century. Authors did not always use this sign, some works of French origin using the initial capital letter P, which stands for "Prenez" or "take." A very large proportion, however, use a capital ℞, with a stroke across its tail. Some authorities claim that this stroke across the tail of the R, as still employed today, is a remnant of the diagonal stroke which appears in the sign of Jupiter, ♃. The principal authority for this statement is John Ayrton Paris, a fellow of the Royal College of Physicians, London, in his celebrated work called "Pharmacologia," published over a century ago. It is a view also held by Professor Otto A. Wall in his celebrated work on "The Prescription."

These and other authorities also state that other planetary signs were also used at times. In my own experience, which covers the examination of several hundred ancient pharmaceutical works of the

sixteenth, seventeenth and eighteenth centuries, this statement has not been confirmed, and honors are about equally divided between the ℔ with the stroke across its tail and the sign of Jupiter, 4.

I am in possession of one book, "The Pharmacœa Lugdensis," of 1674, in which the signs are used indiscriminately, sometimes both being used on the same page, without any apparent system. I have never seen any other planetary sign employed in a printed book at the head of a formula, but I have seen the variant of the Jupiter sign, which is in the form of the letter Z for Zeus, the Greek name of the chief Olympic god. It must be remembered that the ℔ with the stroke across the tail in ancient Latin manuscripts and in French works of the sixteenth century was used as an abbreviation for "rum," as in Amarum (shortened to Ama ℔), and also that in some old manuscripts the scruple sign (℈) is used in place of "ejus," and the drachm sign (ʒ) for the ;.



10 A Q

quod in Alopecia mirè prodeſt, in ſurditate etiam valet auribus inſtillata.

* *Aq. Cucumerum comp.* ℞ Succ. cucumer. hort. ℔iv. vin. alb. ℔vj. Theear. fabar. ℔iſs. Fol. cum radic. ononid. ℔j. Bac. junip. ʒvj. n. m. no xxi. Sem. petroſel. ʒiv. Saxifrag. alb. ʒiſs. Fl. geniſt. m. viij. ſambuc. lamii. alb. ā m. vj. ♌a ſ. a. ad ſiccitatem. *Doſ.* ʒij. *omni mane, præmiſſis pil. ex terebinth. Cypr. in calculo & arenulis expellendis.*

Aq. Cynosbati comp. ℞ Fruct. Cynorrh. cum ſem. contuſ. ʒvj. Sem. raphan. ʒiſs. petroſel. ʒj. ſaxifrag. ʒij. Rad. ſaxifrag. alb. ʒj. glyc. ʒiij. alth. ʒvj. ſeri lactis ℔x. ♌a ſ. a. *Doſ.* ʒiv. *bis in die cum Syr. de Alth. & de pertulac. præmiſſ. conf. cynosbati.*

Aq. Digitalis. ℞ Fol. Digitalis rec. ʒxij. glyc. ʒiv. aniſ. ʒij. cereviſ. fort. ℔xij. fermenta ♌ 19. ac ♌a ſ. a. *Antaſthmatica inſignis eſt: & optimè valet ad promovendam expectorationem. Doſ. Cochl. aliquot ſæpe.*

* *Aq. Embryonum.* ℞ Rad. eryng. rec. ℔j. dactyl. ℔ſs. amygd. dulc. non decort. ℥iv. contuſ. in pulp. adde n. m. ʒiij. mac. ʒiſs. Aq. cinam. hordeat. ℔iſs. vin. Hiſpan. Aq. Meliſ. ā ℔j. ♌a ſ. a. *Doſ.* ʒij. *ter in die cum ſacch. perlat. præmiſ. elect. ex conſ. roſ. r. gariophyll. n. m. condit. pul. ebor. margarit. &c.*

* *Aq.*

A Q 11

* *Aq. Epidemica.* ℞ Fol. chelidon. roriſm. rutæ, ſalv. artemiſ. abſ. anagal. dracont. ſcabioſ. agrim. meliſ. ſcord. centaur. min. card. b. beton. roris ſol. ā m. ij. Rad. angel. torment. gentian. zed. glyc. ā ʒj. macer. in Vin. alb. ℔viij. ♌ 2: dein ♌a ſ. a.

* *Aq. Febrifuga.* ℞ Summit. centaur. min. m. viij. abſ. vulg. parthen. pentaphyll. calend. tormentil. nicotian. virid. acetoſ. card. b. dracont. chamæm. chamædr. ā m. vj. taraxac. m. xij, contuſ. adde Leuccen. ℔iv, & ♌a, & ▽æ ♌atæ novis affuſis herbis macer. ac ♌a ad ſiccit. In ▽ ♌at. infund. Rad. fraxinel. tormentil. ā ʒiſs. Sem. citri, cardui ben. card. Mariæ, acetoſ. ā ʒij. Fol. ſcord. galeg. ā m. iv. ♌a ſ. a.

Aq. Formicarum. ℞ Formicar. major. (Majo vel Jun. collect.) ℔j. mellis ℔ij. hydropeg. ℔j. ♌a ſ. a. *Doſ. cochl. i. vomitum ciet & curat febres Tertianas.*

Aq. Fortis Duplex. Fit ex ☽ & ♁ ā, per ♌atis ſ. a. *Solvit* ☽ & ♀.

Aq. Fortis Aluminata. ℞ ☉ calcin. ☽, ā ℔j, ♁ ℔ſs. ♌a ſ. a.

Aq. Herpetica. ℞ ☉ ʒj. ♁ alb. ʒij. ♌ opt. ℔j. Rad. Enul. rec. ʒij. Fol. virid. Nicotian. m. i. coq. ad conſ. ʒtiæ part. colat. adde ♁ uſt. ʒiſs. *Cum iſtius q. ſ. pannis madefactis*

No. 5. Specimen pages from Pharmacopoeia Bateana, Third Edition, London, 1700. Note the frequent use of symbols in the text for space-saving purposes, not for secrecy, as the list of symbols with their equivalents is given at the beginning of the book.

The other unsolved problem is the question as to when the skull and crossbones originated as the "poison" symbol in pharmacy. The plain skull or death's head had been emplbyed for centuries by the alchemists to designate the residue left in the retort after a distillation, and which was called the "caput mortuum"—literally, the dead head. When the crossbones were added and the other meaning was given has not yet been ascertained.

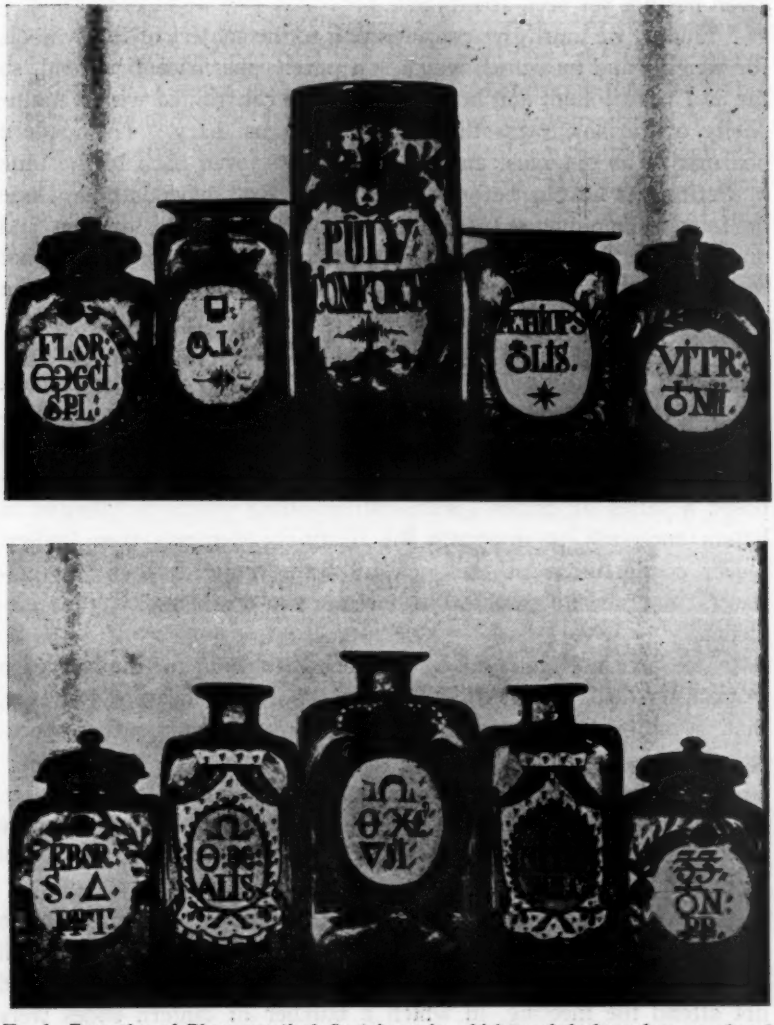
Finally, we must give consideration to the subject of the symbols for weights and measures, which is a purely pharmaceutical field, so far as I have found, and here again we are confronted with a multiplicity of variant forms that fairly makes us dizzy. The modern pharmacist, as did most ancient pharmacists, even back to the time of Scribonius Largus before the Christian Era, depends upon three or four commonly used signs for the grain, scruple, drachm and ounce, respectively, and one of these, the gr., is an abbreviation, not really a symbol. In a composite pharmaceutical work published in 1652 there is a single table giving nearly fifty different signs for weights then in use and Lüdy's researches have collected a greater total even than this. The chemist of today who uses the modern symbols of that science which are based upon abbreviations or contractions of the name of the element, usually does not realize that Dalton in his original atomic theory, published in about 1800, proposed a series of circles (with distinguishing geometric designs or letters enclosed) to designate the thirty-six elements then known. Queer combinations of these circles were resorted to by his followers in order to graphically illustrate the compounds of the elements.

We have not had time to do more than skim the surface of a fascinating field for research. I would warn my hearers, however, that, in my opinion, one who specializes too intently in such a speculative field is apt to become a bit "balmy."

Some recent observations, following a conversation with Dr. W. J. Wilson, of the mss. Division of the Library of Congress, have led to discoveries and opinions about the origin of the ℞ which will be presented in a subsequent article.

I have been requested to publish this address, and in order to do so I shall have to make a selection of the illustrations which will be necessary to make the presentation intelligible to those who did not attend the meeting, in which a number of lantern slides were

used. In consequence of this, I have selected a series of illustrations which are self-explanatory when interpreted by the captions, and it is hoped that the publication of the article will, perhaps, stimulate some additional research upon the main subject and its collateral branches, any one of which is worthy of the efforts of one who is sincere in his desire to add to the sum total of human knowledge.



No. 6. Examples of Pharmaceutical Containers in which symbols have been employed to save space. From Alchemistische und Chemische Zeichen. Dr. F. Lüdy, 1928.

THE ASSAY OF OINTMENT OF BORIC ACID

By Robert M. Lingle

OINTMENT of boric acid is given recognition by the United States Pharmacopœia although no assay procedure is included in the official text.

Budin (1) has pointed out that the boric acid content may be determined as follows: "Place 25 cc. chloroform, 10 cc. glycerin and 1 cc. of phenolphthalein T. S. in a well stoppered container. Shake, add N/10 alkali to faint pink color. Then introduce about 1 gm. of boric acid ointment weighed on wax paper, add 25 cc. of N/10 NaOH. Shake well and determine excess of N/10 NaOH by titration with N/10 H_2SO_4."

In checking this method, the writer has found it to be satisfactory if two important factors are considered. One of these is that a blank determination be made on the reagents and the result subtracted from the amount of boric acid obtained in the assay of the ointment. The other concerns the time element.

In this investigation several assays were made and these were completed in periods ranging from one hour to sixteen hours. It was found that the calculated per cent. of boric acid increased when the time of titration was delayed. An attempt was made to find the reason for this increase by undertaking a study of five series of experiments in which different combinations of reagents were used. The ointment boric acid was prepared to contain 10.1 per cent. of boric acid. The conditions for each series are given as follows:

Series I. Regular assay of ointment boric acid (Budin's Method). No allowance made for blank figure.

Series II. Substituted petrolatum for ointment boric acid.

Series III. Reagents only.

Series IV. All reagents except glycerin. Ointment boric acid omitted.

Series V. All reagents except chloroform. Ointment boric acid omitted.

In order to ascertain the effect of varying periods of time on the results obtained, the assays were arranged to be completed within one hour, two hours, four hours, six hours and sixteen hours, respectively. Each result shown in Table I represents an average of several determinations.

TABLE I

	One hour per cent. H_3BO_3	Two hours per cent. H_3BO_3	Four hours per cent. H_3BO_3	Six hours per cent. H_3BO_3	Sixteen hours per cent. H_3BO_3
Series I	10.46	10.53	10.79	10.92	12.10
Series II	0.375	0.46	0.81	1.02	2.33
Series III	0.093	0.449	0.82	1.13	2.44
Series IV	1.21	1.82	3.17	5.12	9.89
Series V	0.102	0.127	0.118	0.147	0.153

In the above table, Series II corresponds to the blank determination previously mentioned. It is noted that the calculated per cent. of boric acid increases in all five series, although the rate of increase is not uniformly constant as is shown by Table II in which case the actual per cent. of boric acid is calculated by subtracting the results of Series II from those of Series I.

TABLE II

	One hour	Two hours	Four hours	Six hours	Sixteen hours
% H_3BO_3	10.085	10.069	9.98	9.90	9.77

These results would indicate that the determination must be completed within two hours in order to insure accurate results. In case that a long period of time is permitted to elapse, the results tend to be low.

A study of Table I leads to the conclusion that chloroform is the reagent which causes this variation. Textbooks of organic chemistry inform us that with alkalies chloroform yields formic acid according to the equation:

$$\begin{array}{l} \mathrm{Cl} \\ | \\ \mathrm{H\text{-}C\text{-}Cl} \\ | \\ \mathrm{Cl} \end{array} + 3\mathrm{KOH} \rightarrow 3\mathrm{KCl} + \mathrm{H_2O} + \begin{array}{l} \\ \\ \mathrm{H\text{-}C\text{-}OH} \\ \\ \mathrm{O} \end{array}$$

The formic acid which is produced neutralizes a part of the caustic soda used in the assay of boric acid ointment and for this reason the calculated per cent. of boric acid is too high unless an allowance is made by subtracting the result of a blank determination which has been made on the reagents. It is generally known that alcohol serves as a preservative for chloroform in preventing its decomposition into phosgene and hydrochloric acid, in the presence of air and oxygen. The results in Table I show that glycerin, an

alcohol, has a tendency to a certain extent to prevent chloroform from decomposing into formic acid in the presence of alkali.

The author is indebted to Mr. E. J. Hughes for his assistance in the preparation of this manuscript.

Conclusions

1. In determining the boric acid content of ointment of boric acid by the Budin (1) method, a blank determination must be made on the reagents.

2. The assay must be completed within two hours in order to obtain an accurate result.

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FEMALE PLANT SECRETIONS—It seems to be only a matter of time before science workers will have discovered many interesting similarities between the life processes of plants and animals. Probably the present outstanding example is the close resemblance of the life-supporting plant product, chlorophyll, to the corresponding constituent in animal blood, the hemoglobin. The chemical constitution and function of these two products are surprisingly alike. Chemically, the important difference is that magnesium constitutes the inorganic element of chlorophyll while iron forms the keystone in hemoglobin.

Just recently, B. Skarzynski reported the results of a chemical examination of the female flowers of the willow tree. Through proper treatment he was able to extract a small quantity of folliculin hydrate from ten thousand times its weight of flowers. Folliculin hydrate has been known to chemists for some time and usually has been obtained from well-known animal sources. It is classified as a sex hormone and may be obtained in appreciable quantities from the urine of pregnant female vertebrates. Folliculin hydrate produces estrogenic action and mice injected with it exhibit sexual excitement. —*C.* (*Jour. F. I.*).

REPRINTED ARTICLE

THEORY AND PRACTICE OF PARENTERAL FLUID ADMINISTRATION*

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IN THE early stages of undue loss of water from the body, regardless of the cause of such loss, the composition of the blood in respect to its water content and electrolyte pattern tends to remain unaltered because of the stabilizing or buffering effect of the intercellular fluid of the body. This portion of the body may be looked on as a reservoir which may shrink appreciably in order that changes in the blood and perhaps also in the fixed tissue cells may be kept at a minimum. When, however, the intercellular fluid becomes exhausted, changes do appear in the blood indicative of this exhaustion, and probably also in the fixed tissues themselves. The nature of the changes is largely dependent on the manner in which fluid is lost; sometimes acidosis may accompany dehydration, at other times alkalosis, while occasionally a tendency toward one such change may be almost exactly balanced by a tendency in the opposite direction. Also, during a period of excessive fluid loss leading to dehydration, the groundwork for subsequent edema may be laid.

By chemical examination of the blood one can usually obtain undeniable proof of loss of water, chloride, bicarbonate and total fixed base. Loss of other substances, however, such as potassium and calcium, are not usually so indicated, as their concentrations in the blood plasma tend to remain quite fixed, the tissue cells and the bones acting as reserve depots. These facts should be borne in mind when efforts are to be made to replace lost intercellular water, so that restitution may be chemically adequate. Thus, it is frequently necessary to replace lost electrolytes along with water, if the effects of dehydration are to be overcome completely. It may also be necessary to restore plasma protein, or at least to make more normal the colloidal osmotic pressure of the blood in order to reestablish a normal circulation of the blood and a normal interchange of substances between the blood and the intercellular fluid.

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In order to accomplish such a purpose without too much reliance on the aid which renal activity may afford or on the aid with which absorption of food from the intestinal tract may provide, it may be necessary to give parenterally fluids that are quite similar to normal intercellular fluid, or at least to provide the most essential mineral constituents of body fluids. Sodium chloride is the most important salt as far as amount is concerned. It is to be expected, therefore, that administration of isotonic sodium chloride solution should go far toward relief of the phenomena of dehydration. Sodium chloride alone, however, frequently is insufficient to provide complete relief of symptoms (1). The addition of potassium and calcium is at least theoretically indicated, and when such an addition is made in the same proportion in which these elements exist in blood plasma or intercellular fluid, Ringer's solution results. Still more perfect imitations would be such modifications of Ringer's solution as Locke's and Tyrode's solutions.

It should be noted, however, that in both of these solutions the amount of bicarbonate present is much less than in normal blood plasma or intercellular fluid. This is necessary because of the fact that calcium bicarbonate would precipitate if more were to be added. Such solutions, therefore, are not greatly superior to the original Ringer's solution when restoration of diminished bicarbonate (acidosis) is desired. That such a restoration frequently follows the administration of such solutions is admitted, but the reason is not inherent in the solution; it is concerned with secondary effects in improving the circulation and stimulating renal activity. The bicarbonate content of the blood and body fluids, however, can be quite readily restored and maintained by controlled and separate injections of sodium bicarbonate and Ringer's solution. Still more conveniently and just as effectively, the same end may be accomplished by substituting sodium lactate for sodium bicarbonate (2). When such a substitution is made, sodium lactate may be combined with Ringer's solution, with which it is compatible.

The solutions that I have found necessary or desirable in various conditions include (1) Ringer's solution (hypotonic), (2) sodium lactate (isotonic and hypotonic), (3) lactate-Ringer's solution (physiologic buffer salts solution), (4) dextrose solution (isotonic, hypertonic and hypotonic, when in combination with Ringer's solution or lactate-Ringer's solution), (5) sodium bicarbonate, (6) arti-

ficial "spinal fluid," (7) acacia solution, and (8) citrated whole blood or plasma. The composition of these fluids, the methods of their preparation, their specific indications and the manner in which they are to be administered will next be considered.

Methods of Preparation

Ringer's Solution.—I have found it convenient to make Ringer's solution in concentrated form as a stock solution, which is later diluted before using. The following salts in the amounts indicated are dissolved in freshly distilled water and made up to five liters and filtered through a glass disk filter: sodium chloride, 750 gm.; potassium chloride, 50 gm.; calcium chloride, 25 gm.; magnesium chloride, 25 gm.

Magnesium has been added to the original Ringer's solution. Before using, this stock solution is diluted twenty-five times (20 cc. to 500 cc.) with freshly distilled water and sterilized in pyrex Florence flasks of 500 cc. capacity by autoclaving at from fifteen to twenty pounds for thirty minutes.

Sodium Lactate.—This solution, also, can be made most conveniently in a concentrated form: *i. e.*, as a molar solution, which may later be diluted as desired. Molar sodium lactate may be prepared by neutralizing 100 cc. of lactic acid (U. S. P.) with concentrated carbonate-free sodium hydroxide (approximately 40 per cent.), phenol red being used as an indicator. The solution is made up to about 800 cc. with distilled water and heated to the boiling point for from thirty to forty minutes, small amounts of alkali being added meanwhile as needed to neutralize the lactic acid formed through hydrolysis of the anhydride. The solution is then made up to 1000 cc. with freshly distilled water, filtered through a glass disk, sterilized in an autoclave at fifteen to twenty pounds pressure for thirty minutes, and preserved in stoppered flasks or in sealed ampules (3).

Lactate-Ringer's Solution.—If both the hypotonic Ringer's solution and the molar sodium lactate solution are available, lactate-Ringer's solution may be freshly prepared before using by simply adding 10 cc. of the molar sodium lactate solution to from 400 to 450 cc. of the Ringer's solution. If desired, the lactate-Ringer's solution may also be made in a concentrated form (4).

Dextrose Solution.—For intravenous and subcutaneous injection, dextrose solution may be prepared quite easily. A convenient

method is to prepare a 50 per cent. stock solution as follows: Dissolve 1000 gm. of chemically pure dextrose (Mallinckrodt) in about 1950 cc. of hot freshly distilled water; cool; make to 2000 cc. in a volumetric flask and filter, preferably through a glass disk to avoid the inclusion of filter paper threads. From this concentrated stock solution, isotonic dextrose solution (5.5 per cent.) may readily be prepared by diluting 55 cc. to 500 with freshly distilled water; a 10 per cent. solution is made by diluting 100 cc. to 500 and a 20 per cent. solution by diluting 200 cc. to 500. After the dilutions are made, they may be refiltered if necessary and sterilized by autoclaving at fifteen pounds for thirty minutes. It is convenient to sterilize these solutions in pyrex Florence flasks of 500 cc. capacity, which may be used later for injection when fitted with the proper two-hole rubber stopper and tubing.

It is true that, on standing, such solutions become slightly acid in reaction. The total amount of acidity so developed, however, is so small that it is negligible, and, in my experience, does not lead to reactions when injected subcutaneously or intravenously. Only from 5 to 10 per cent. dextrose solution should be injected subcutaneously, as the more concentrated solutions are irritating. Such sterile solutions may be kept in the refrigerator for several weeks, and perhaps even longer, without causing reactions. It has been my policy, however, to make fresh solutions every week. Commercial products in ampule form may also be used if dilutions are made with freshly distilled sterile water before injection. My experience has been entirely satisfactory with such preparations.

For intraperitoneal injection, however, special precautions must be taken. Perhaps the best method is that described by Schwentker (5), in which chemically pure dextrose is sealed in glass ampules and sterilized by boiling in a water bath for thirty minutes on each of three consecutive days. Just before using, the dry dextrose is dissolved in freshly distilled water to make an isotonic 6 per cent. solution. In my own experience, however, distention has so frequently followed the intraperitoneal administration of dextrose that it is no longer given by this route. The explanation for such an undesirable reaction is suggested by the recent work of Darrow and Yannet (6), who found that, when dextrose is injected intraperitoneally, electrolytes and water are first withdrawn from the

blood until the fluid within the peritoneal cavity resembles the blood and intercellular fluid in its electrolyte composition.

Sodium Bicarbonate Solution.—This should be made up freshly before using. For intravenous injection, it is satisfactory to transfer chemically pure anhydrous sodium bicarbonate onto a clean filter paper taken from the middle of a pack with a flamed spatula. In this way the proper amount of sodium bicarbonate may be weighed to make a 5 per cent. solution, the weighed material being added to cool, freshly distilled sterile water. While not absolutely sterile, this material is suitable for intravenous administration and has been used quite extensively without indications of infection. For subcutaneous injection, a 1.5 per cent. solution is made, and a small amount of phenol red indicator is added. The solution is then filtered through a Berkefeld candle and, just before using, carbon dioxide is filtered through water and bubbled through the solution until the red color changes to orange. Such a solution is isotonic, sterile and of a *p*H that is not irritating. Theoretically, such a solution should also be satisfactory for intraperitoneal injection, but I have never used it in this way and therefore cannot recommend its use. Another method of preparing sodium bicarbonate is that suggested by Cunningham and Darrow (7). By this method previously sterilized sodium carbonate is partially neutralized by hydrochloric acid with the formation of sodium bicarbonate and sodium chloride.

Artificial "Spinal Fluid."—This solution was developed particularly to meet the needs of Dr. Ernest Sachs in replacement of lost ventricular fluid during certain intracranial operations, particularly choroidoplexectomy for the relief of hydrocephalus. At the time of injection into the ventricles, this solution closely resembles normal cerebrospinal fluid as far as content of sodium, potassium, calcium, magnesium, chloride, bicarbonate and *p*H is concerned. Because of its bicarbonate content, the solution has to be prepared in two parts, which, after sterilization by autoclaving and proper dilution, are mixed in equal amounts just before using.

Solution 1 (concentrated): Preparation is as follows: sodium chloride, 300 gm.; potassium chloride, 19 gm.; calcium chloride, 10 gm., and magnesium chloride, 20 gm. are added to 1 liter (1000 cc.) of freshly distilled water. Filter (preferably through a glass disk filter to exclude filter paper fibers). Autoclave at fifteen pounds for thirty minutes. This is the concentrated solution 1 which should keep in pyrex glass indefinitely.

To prepare for mixing with solution 2, measure accurately 10 cc. (with a sterile pipet, so as not to contaminate the stock solution) and make to 250 cc. with freshly distilled water. It is convenient to do this in a 250 cc. volumetric flask. Make up to the mark, and then withdraw 10 cc. with the same pipet, leaving 240 cc. Place this amount in a pyrex glass flask or bottle of 500 cc. capacity, mix, and resterilize by autoclaving at fifteen pounds for thirty minutes. Stopper with sterile (autoclaved) cork or rubber stopper. It is usually convenient to prepare about six such bottles of 240 cc. each of solution. This solution may be resterilized at any time, if thought advisable.

Solution 2: Weigh out 5 gm. of anhydrous sodium bicarbonate. Add a few milligrams of dry phenol red (phenolsulphonphthalein) and make to 1 liter (1000 cc.) with freshly distilled water. Filter free of any suspended particles. Measure 240 cc. of this solution into a pyrex glass flask or bottle of 500 cc. capacity and sterilize by autoclaving at fifteen pounds for thirty minutes. Stopper with a sterilized (autoclaved) cork. In this condition the solution may be resterilized at any time, if thought advisable.

Just before using, add exactly 1 cc. (measured with an accurate sterile pipet) of concentrated hydrochloric acid (36 per cent.) to 240 cc. of solution 2, and mix by rotating the flask or bottle. The sodium carbonate should now be converted into sodium bicarbonate plus sodium chloride, and the color should change from red to an orange shade. If such a change does not occur, a drop more of the acid should be added. At this stage the solution can no longer be resterilized. Pour equal parts of solution 2 (after the addition of the hydrochloric acid) into solution 1 and mix by rotating the flask. This final mixture has now the composition of normal spinal fluid and is now ready for injection into the ventricles.

Acacia Solution.—While it is possible to prepare acacia solution satisfactorily for intravenous injection, it has proved much more convenient to use products already prepared, such as the product marketed by Eli Lilly & Co. This product is marketed in 30 per cent. concentration and contains 4.5 per cent. sodium chloride. Its most frequent use is its intravenous injection in cases of shock. For this purpose the original material is diluted five times with sterile distilled water or 20 per cent. dextrose solution, so that the final concentration of acacia is 6 per cent. and sodium chloride 0.9 per

cent. When it is used for the relief of nephrotic edema, such dilution is unnecessary and the material may be used as marketed or diluted just sufficiently to enable it to flow readily by gravity (8).

Specific Indications

Ringer's Solution.—This solution is indicated whenever chlorides and the fixed bases sodium, potassium, calcium and magnesium have been lost. Therefore it is indicated in all forms of dehydration, but particularly in cases in which large amounts of gastro-intestinal secretions have been lost by vomiting, diarrhea or fistula, as occurs in such conditions as pyloric and intestinal obstruction, diarrhea, diabetic acidosis, glomerular nephritis (terminal stage) and many severe infections. Beneficial effects in acidosis or alkalosis result indirectly from improvement of the circulation and stimulation of renal activity. While Ringer's solution may be administered by any of the parenteral routes, it finds its chief use when administered subcutaneously or intraperitoneally. Ordinarily therapeutic doses, adequate for restitution of lost water and minerals, average from 80 to 100 cc. per kilogram of body weight.

Sodium Lactate Solution.—This solution is indicated in specific amounts in all types of severe acidosis other than that associated with congenital heart disease with persistent cyanosis. It is of value also for rapid alkalinization of the urine in the treatment of acute infections of the urinary tract. Sodium lactate may be administered by any of the parenteral routes. It is important that an isotonic solution be used for subcutaneous or intraperitoneal administration. One-sixth molar sodium lactate is isotonic and is made by adding one part of the molar sodium lactate solution to five parts of sterile distilled water. Somewhat more concentrated solutions may be given intravenously, but, especially during the presence of dehydration, it is unwise to use a solution more concentrated than the isotonic solution. If the carbon dioxide content of the blood is known, the amount of sodium lactate that will be required to raise the carbon dioxide content to the normal value of sixty volumes per cent. may be calculated (2). Since, however, the chief indication for the use of sodium lactate is the presence of a carbon dioxide content under 25 volumes per cent., a routine dose of 10 cc. of the molar solution per kilogram of body weight, diluted with five volumes of distilled water, will be generally satisfactory; *i. e.*, this amount will tend to

increase the carbon dioxide content by 25 to 35 volumes per cent. When merely alkalinization of the urine is desired, smaller amounts, *i. e.*, 5 cc. molar solution per kilogram of body weight, are effective.

Lactate-Ringer's Solution.—Since its effect in the body is to relieve either acidosis or alkalosis of the metabolic types, lactate-Ringer's solution is indicated in all types of dehydration, especially when a chemical study of the blood has not been made. When severe alkalosis of the metabolic type is known to exist, the addition of lactate to the Ringer's solution is without benefit, aside from its antiketogenic and glycogenic effects. The addition of lactate to Ringer's solution, however, need not be feared, even if very severe alkalosis is present. The results obtained in such cases by (1) Ringer's solution, and (2) lactate-Ringer's solution are illustrated in chart 3. When very severe acidosis is known to be present, the amount of lactate indicated is of such an amount that it is much better to give the lactate independently of the Ringer's solution (*i. e.*, as sixth molar sodium lactate), and later, if further fluid administration is necessary, it may be combined with Ringer's solution to prevent recurrence of acidosis.

Lactate-Ringer's solution may be given by any of the parenteral routes. It has almost entirely replaced the use of physiologic solution of sodium chloride or Ringer's solutions in the St. Louis Children's Hospital for the routine treatment of dehydration with or without the knowledge of coexisting chemical changes. When administered by the subcutaneous or intraperitoneal routes or as a single intravenous injection, therapeutic doses should average from 80 to 100 cc. per kilogram of body weight. Mixed with 10 per cent. dextrose solution, it has been the fluid of choice for the continuous intravenous drip method of providing fluid.

Sodium Bicarbonate Solution.—The indications for the use of sodium bicarbonate solution are the same as for sodium lactate solution. It is superior to the latter only in those conditions in which lactate metabolism may be seriously impaired (congenital heart disease with anoxemia being the only one that has been encountered so far in my experience), but it has many disadvantages (2). A somewhat hypertonic solution may be given intravenously in a case of severe acidosis in a dosage of 0.5 gm. of sodium bicarbonate per kilogram of body weight. A sterilized isotonic solution containing

carbon dioxide in the proper amount may be given subcutaneously in corresponding amounts.

Dextrose Solutions.—Dextrose solutions are indicated when the carbohydrate metabolism is low, when ketosis exists, when hypoglycemia is present, and when there is depletion of liver or muscle glycogen: *i. e.,* in such conditions as starvation, acute severe infections, intoxications, particularly in cases in which the liver and heart muscle are affected, and in hyperinsulinism. It is also of value in promoting diuresis and for this purpose may be used in acute nephritis with acute cerebral edema. Isotonic dextrose solution may be given subcutaneously or intravenously or, as previously mentioned, it may be mixed with equal parts of lactate-Ringer's solution to be given by either of those two routes. More concentrated solutions, even up to 50 per cent., may be given intravenously, when in particular edema is to be treated and when diuresis is particularly to be established. There is some danger of venous thrombosis when 50 per cent. dextrose is used, particularly if the circulation is sluggish. Since dextrose solutions are given both for their dextrose and for their water content and for the relief of edema, no exact dosage can be given. In general, when given for purposes of administering fluid, from 80 to 100 cc. per kilogram may be given subcutaneously, and, roughly, from one-fourth to one-half that amount may be given as a single intravenous injection. When given in conjunction with lactate-Ringer's solution by the continuous drip method, the rate of flow should be from 3 to 6 cc. per kilogram hourly after dehydration has been relieved.

Artificial "Spinal Fluid."—The use of this solution has been as yet confined to cases in which operation is performed for hydrocephalus in which it is desirable to refill collapsed ventricles. Theoretically, at least, this solution should be much superior to physiologic solution of sodium chloride whenever replacement of, or admixture with, cerebrospinal fluid is to be considered, in such instances as "through and through" drainage for meningitis, spinal anesthesia and nerve block.

Acacia Solution.—Acacia is especially indicated when the blood volume has been reduced as the result of hemorrhage or shock. In such conditions the injection of electrolytes or nonelectrolyte crystalloids, such as dextrose, does not have much of an effect in increasing the blood volume, since they are free to pass through the capillary

walls and actually diffuse quite rapidly into the tissue fluids. The plasma proteins and acacia, however, are normally impermeable, remain in the circulation and through their effect in raising the colloidal osmotic or oncotic pressure tend to maintain blood volume. In nephrotic edema the oncotic pressure of the plasma is reduced because of loss of protein from the blood, chiefly as the result of albuminuria. The glomerular membrane in such conditions is less permeable to acacia than to the plasma proteins, and through its use in such conditions the oncotic pressure of the plasma usually can be restored to a level sufficiently high to lead to loss of edema fluid. Acacia should be administered only intravenously, the concentration varying from 6 to 30 per cent. The solution injected should have roughly a sodium chloride concentration of from 0.6 to 0.9 per cent. Since the effect on edema of injected acacia depends largely on the concentration of acacia which is maintained in the blood plasma, which in turn is dependent on the amount given in relation to the original blood volume, the rate of excretion into the urine and the rate at which it is taken up by other tissues, the dose of acacia cannot be fixed (8). In general, however, from 1 to 2 gm. of acacia per kilogram of ideal body weight is given intravenously over a period of forty-five to sixty minutes and may be repeated daily until as much as 10 gm. per kilogram has been given.

Blood.—Specific indications for the administration of whole blood are: (1) reduction in blood volume, resulting from hemorrhage or prolonged malnutrition; (2) severe anemia, particularly if the erythrocyte count is low; (3) blood dyscrasias associated with a bleeding tendency, such as hemorrhagic disease of the new-born and hemophilia; (4) edema which is due chiefly to diminished plasma protein ("nutritional" edema, nephrosis and chronic active glomerular nephritis), and (5) possibly icterus gravis of the new-born and other types of hemolytic anemias. In such instances there is either a qualitative or a quantitative deficiency of whole blood or some of its components, such as erythrocytes, platelets or plasma. As a rule, sufficient whole blood may be given to correct such a deficiency. The most important exception is the edema of nephrosis, in which the protein loss through the kidney may equal or excel the rate at which protein can be injected as whole blood. In such instances, larger amounts of protein may be administered as plasma transfusions or, as is not infrequent, a substitute for protein in the form

of acacia must be relied on. In a number of instances of rheumatic heart disease with failure, severe anemia was relieved by transfusing cells suspended in citrated saline solution without running the risk of increasing the cardiac embarrassment by increasing the blood volume or viscosity by adding more plasma protein.

Blood transfusions have also been extensively used in both acute and chronic infections, with the hope of administering antibodies. Probably because of the frequent lack of such antibodies in high concentration, results in such cases have often been disappointing.

In general the intravenous route is the one of choice, particularly if the function of the erythrocytes is to be preserved. The usual amount of blood given in this way is about 20 cc. per kilogram of body weight. More may be given safely in cases of hemorrhage, while in the presence of cardiac or pulmonary lesions it is often desirable to repeat much smaller transfusions (5 cc. per kilogram). In states of severe nophrotic edema, very much larger amounts of plasma may be given, because of the rapid loss of plasma protein by way of the urine. When given subcutaneously or intramuscularly, the erythrocytes are destroyed but the plasma elements rapidly make their way into the blood stream. Under favorable conditions apparently most of the blood given interaperitoneally finds its way rapidly into the circulation. My experience with very sick infants, however, has been discouraging, in that abdominal distention tends to result, and in several instances, most, if not all, of the blood injected was found unabsorbed after death several days later.

Combinations of Various Solutions.—Injection of sodium lactate and Ringer's solution has already been considered. In a similar fashion, dextrose may be combined with Ringer's or lactate-Ringer's solution. As a rule, it is best to mix isotonic solutions in equal volumes, so as to preserve isotonicity. Equal parts of 10 per cent. dextrose solution, however, may be added to Ringer's or lactate-Ringer's solution and given intravenously without any deleterious effect. Dextrose and sodium bicarbonate may be mixed, if the resultant mixture is given immediately. On standing, however, dextrose decomposes much more rapidly in the presence of alkali. Sodium bicarbonate cannot be mixed with Ringer's solution without precipitation of calcium bicarbonate. Since acacia solution contains considerable amounts of calcium, bicarbonate solution and acacia are

also incompatible for this reason. Acacia cannot be mixed with citrated whole blood either, since the calcium content of the acacia will neutralize the effect of the citrate and permit clotting to occur.

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LIFE AND DEATH—"Life is a continuous conflict with death—and in the individual, death is the inevitable victor. There is a master poisoner in the shadows, ever scheming with his endless toxic ways earth's children to destroy. His is the joy of analysis. Never satisfied with our pattern, he destroys us—disorganizes—and returns to dust again our precious constitutions, there to remain till Life the synthesist again comes wandering by and binds our poor dust once more in its electric fluid."

HEART HEALTH—"To maintain heart health in the perilous forties, one should observe ordinary frugality in physical expenditures; one should cultivate tranquillity in the presence of mental storms and meet with dignity and poise all bombardments of the emotions."—S. Calvin Smith in "That Heart of Yours" (Lippincott).

SCIENTIFIC AND TECHNICAL ABSTRACTS

Compiled by Arthur Osol, Ph. D.

Quinone: A Reagent for Amines. M. Foucry. *J. Pharm. Chim. 126,* 116-118 (1934). This author finds that the addition of 5 cc. of a solution containing five parts of acetic acid and one part of quinone in 100 parts of alcohol to 5 cc. of an aqueous, neutral, or slightly acetic acid solution of an amine produces a red color after the mixture is boiled and then cooled. If appreciable quantities of amine are present the color develops immediately, if very small quantities are present the color develops during cooling. Mineral alkalies and concentrated solutions of ammonium salts interfere with this reaction. The test is applicable to such substances as hydroxylamine, aniline, phenylhydrazine, piperazine, hexamethylene tetramine and pyridine. It is of interest to point out that this reaction permits the differentiation of certain related products. Thus pyramidon is distinguishable from antipyrine in yielding a positive test in this reaction. Nitrogen containing developers may be distinguished from hydroquinone by this test. Certain amino acids, such as glycocoll and alanine, give a positive reaction, while other substances, such as cystine, taurine and tyrosine do not respond. It is also possible to differentiate between novocaine and stovaine. For this test it is advisable to add a drop of concentrated sulphuric acid before adding the reagent, and boiling, novocaine responding positively while stovaine produces no color.

Determination of Hexamethylenetetramine by Precipitation of the Double Uranyl and Hexamethylenetetramine Sulphate. M. Foucry. *J. Pharm. Chim. 126,* 168-170 (1934). The reagent for this determination is prepared by adding, in small portions, 30 cc. of 66 degree sulphuric acid to 170 cc. of 95 per cent. alcohol, the mixture being cooled by running water. Ten grams of uranyl nitrate are then dissolved in the mixture.

For the determination of hexamethylenetetramine an equal volume of reagent is added to a portion of solution containing not more than 5 grams of hexamethylenetetramine per liter. The mix-

ture is allowed to stand for one hour, after which the supernatant liquid is decanted through a tared filter and the precipitate subsequently transferred to the filter with the least possible quantity of 50 per cent. alcohol containing five parts by volume of 66 degree sulphuric acid. The precipitate is washed with 95 per cent. alcohol until the filtrate ceases to give a reaction for sulphate with barium chloride and then twice with anhydrous ether. After allowing the ether in the precipitate to evaporate the latter is dried for ten minutes at 80 to 100 degrees. The weight of the precipitate multiplied by 0.232 gives the weight of hexamethylenetetramine. The determination is not affected by mineral or organic acids and the author has found no interfering constituents in the many preparations which he has studied.

The Volumetric Determination of Titanium. E. Tschirch. *Pharm. Zentralhalle, 75,* 513-515 (1934). Because of the extensive uses and applications of titanium dioxide, the author has undertaken to find a simple method for its determination. The method proposed depends upon the reduction of tetravalent titanium to the trivalent condition, the latter in turn reducing an equivalent quantity of ferric iron which is determined by titration with potassium permanganate solution. The detailed procedure is as follows: Approximately one gram of the sample is weighed accurately and heated to destroy organic matter. The residue is digested with 20 cc. of concentrated sulphuric acid and 8 grams of anhydrous sodium sulphate and diluted with water after decomposition has been effected. Barium sulphate, talcum and any other precipitate is filtered off. The solution, which contains tetravalent titanium, is now reduced by passing it through a Jones reductor, the emergent liquid being collected in an Erlenmeyer flask containing 50 cc. of a solution of 320 grams of ferric sulphate in one liter. The Erlenmeyer flask is fitted with a two-hole rubber stopper, the exit tube of the reductor passing through one hole while an aspirator is connected through the other. The trivalent titanium reduces an equivalent quantity of ferric iron and the determination is completed by titrating the reduced iron with N/10 potassium permanganate solution. Each cc. of the latter is equivalent to 0.00801 gram of TiO_2. Iron may interfere if it is present, and may be determined in another assay by adding bisulphite

to the solution of tetravalent titanium which reduces iron but not titanium. After expelling the excess sulphurous acid, the iron is determined by titration with potassium permanganate, and a correction made by subtracting this quantity from that used in the determination of titanium.

Determination of Nicotine. J. Bodnar and L. Nagy. *Zeit. Unters. Lebensm. 67,* 598 (1934). Through *Pharm. Zentralhalle, 75,* 508 (1934). One gram of tobacco is shaken with 1 cc. of 20 per cent. solution of sodium hydroxide and 20 cc. of ether-petroleum ether (1:1) mixture in a 50 cc. glass stoppered cylinder. After the supernatant liquid has become clear, a 10 cc. portion is transferred to a 100 cc. Erlenmeyer flask and evaporated on a water bath to 1 to 1.5 cc. To the dark, greenish-brown, viscous residue one adds 10 cc. of water and one or two drops of a saturated alcoholic solution of methyl red and titrates with N/100 hydrochloric acid to the production of a red color. Each cc. of N/100 acid corresponds to 1.62 milligrams of nicotine.

A Method for the Determination of the Saponification Number of Fats and Waxes. J. M. F. Leaper. *Dyer, Calico Printer, Bleacher, Finisher, 70,* 433 (1933). Through *Pharm. Monatshefte, 15,* 196 (1934). Instead of dissolving potassium hydroxide in alcohol as directed in the procedure of Koettstorfer, Leaper recommends solution in diethyleneglycolethylether (Carbitol). The saponification value is then determined by heating on a hot plate 2 grams of fat or wax with 5 cc. of alcohol and 25 cc. of the Carbitol solution of potassium hydroxide (prepared by dissolving 30 grams of the latter in 20 cc. of water and diluting to 1000 grams with Carbitol). The mixture is cooled, diluted with 100 cc. of alcohol and titrated with 1.0 normal sulphuric acid. A blank determination is not necessary.

A New Method for the Determination of Iodine. D. R. McCullagh. *J. Biol. Chem. 107,* 35-44 (1934). The method depends upon the isolation of iodine by a process of alkaline digestion followed by acid distillation and conversion to iodate. The detailed procedure, as applied to blood, is as follows: 10 cc. of blood are placed in a 300 cc. nickel crucible along with 12 cc. of a saturated solution of

potassium hydroxide, and heated gently over a Bunsen flame. At first there is excessive foaming and either the burner must be manipulated under the crucible or the crucible must be manipulated over the flame. In any case, it is probably wise for the chemist to wear spectacles during this procedure, because careless manipulation may result in spattering, although this contingency is never encountered by experienced, careful workers. When the foaming abates somewhat, the organic material is washed from the sides of the crucible with a small quantity of water. The boiling is continued for a few minutes, and the walls of the crucible are washed two or three times with small quantities of water. Then the mixture is boiled until foaming ceases. This procedure requires about fifteen minutes. The crucible is placed in a muffle furnace at 250 degrees for thirty minutes during which time volatile and inflammable gases are driven off. The temperature is increased to 360 degrees and is kept there for ten minutes.

After cooling, sufficient water is added to the crucible to dissolve all the easily soluble material, the lumps being broken down with a stirring rod. Any excess of water is boiled off gently, until a fluid paste is formed, after which 25 cc. of 95 per cent. alcohol are added. After some minutes of stirring, the alcohol is decanted off into a 300 cc. nickel crucible containing 1 cc. of a saturated solution of potassium hydroxide. The sludge in the crucible is then leached four more times with 10 cc. portions of alcohol. If, during this procedure the fluid sludge forms a thick paste, it is moistened with a few drops of water. After extraction, the sludge contains none of the iodine. The alcohol is evaporated on a steam bath and the contents of the crucible are dried gently over a free flame. The crucible is placed in a muffle furnace at 385 degrees for ten minutes. A stream of oxygen (two liters per minute) is passed through the oven during the process of ashing.

The residue in the crucible is dissolved in water and filtered into a 500 cc. Claissen flask which is connected to an upright condenser. The outlet of the condenser dips under the surface of a mixture consisting of 25 cc. of water, 0.5 cc. of a 3 per cent. solution of sulphuric acid, and 0.5 cc. of a 10 per cent. solution of sodium bisulphite contained in a 250 cc. Fresenius absorption flask; 10 cc. of a 50 per cent. solution of sulphuric acid, 2 cc. of a 10 per cent. solution of ferric sulphate, and 2 cc. of a 30 per cent. solution of

hydrogen peroxide are added through a dropping funnel fitted to the Claissen flask, more acid being added if necessary to make the solution strongly acid. The presence of ferric hydroxide serves as an indicator. The mixture is distilled for one-half hour with frequent additions of 30 per cent. solution of hydrogen peroxide. At the end of this step, the volume of solution in the Claissen flask should have been reduced to about 50 cc.

The distillate is transferred to a 600 cc. beaker and carbon dioxide and sulphur dioxide are expelled by boiling for three minutes. Immediately a 10 per cent. solution of potassium hydroxide is added until the solution is alkaline to litmus paper. This solution is then evaporated to a volume of about 10 cc. and transferred to a 50 cc. Erlenmeyer flask by washing the beaker three times with small quantities of iodine-free water. One drop of methyl orange is then added and the solution neutralized with a 3 per cent. solution of sulphuric acid, two drops being added in excess. One drop of bromine is then added which should produce a yellow solution after shaking. The solution is then evaporated to about 2 cc. and cooled on ice, one drop of a 1 per cent. solution of starch and a minute crystal of potassium iodide are added and the titration is carried out with a 0.001 N solution of sodium thiosulphate. A microburette or a pipette may be used for the titration. One cc. of 0.001 N thiosulphate solution is equivalent to 21.2 micrograms of iodine. This method has also been applied to the analysis of potassium iodide, potassium iodate, diiodotyrosine, and p-iodobenzoic acid. The procedure can be greatly simplified when used for the determination of iodine in substances containing larger amounts of that element and less organic material than blood.

The Decomposition of Citric Acid by Bacillus Aertrycke. W. F. Bruce. *J. Biol. Chem. 107,* 119-129 (1934). A study of the chemical changes which occur when B. aertrycke is cultivated on a synthetic citrate medium with ample exposure to air revealed the formation of formic, acetic and succinic acids and carbon dioxide. Comparison of the rough and smooth forms of this bacillus showed that the smooth form produces more formic and acetic acids, less carbon dioxide and succinic acid; and in addition, small amounts of lactic acid.

The Determination of Iron in Biological Materials. T. G. Klumpp. *J. Biol. Chem. 107,* 213-223 (1934). A procedure for the determination of iron in blood, food, feces and urine is given. The technique for the determination of blood iron is as follows: 1 to 5 cc. of oxalated or defibrinated blood, drawn by means of a platinum or a rustless alloy needle, are accurately measured with a pipette into a porcelain evaporating dish. 0.1 cc. of iron-free concentrated sulphuric acid is added for each cc. of blood or each 2 cc. of serum. The combination is dried for about three hours on the steam bath and then heated in a muffle furnace below 550 degrees until it has been reduced to a fine white or pinkish white ash. At 500 degrees this ordinarily consumes about eight hours (the author found that there is no loss of iron below 700 degrees). The ash is taken up with a few cc. of 20 per cent. iron-free sulphuric acid, heating on a steam bath if necessary. This solution is then transferred to a 25 cc. Erlenmeyer flask, the oxygen removed by bubbling carbon dioxide through the solution and the iron titrated with titanium chloride solution in an atmosphere of carbon dioxide. Potassium thiocyanate is used as indicator. A burette with a tip sufficiently long to allow immersion into the solution is used.

The titanium chloride solution is prepared by adding 15 cc. of a 15 per cent. solution to 1000 cc. of distilled water through which has been previously bubbled carbon dioxide and storing in a bottle containing the same gas. Solutions of ferrous ammonium sulphate, in which the iron has been oxidized with potassium permanganate, are used as standards.

Influence of Emulsions on Bacterial Toxins. G. N. Myers. *British Medical Journal, 945,* 3829 (1933) through *Chemist and Druggist, 120,* 706 (1934). This is a report of an investigation into the action of emulsions on toxins. It is well known that fine suspensions of charcoal or kaolin have the property of adsorbing ferments and certain toxins both inside the body and *in vitro.* Finely divided oil globules in emulsions carry a negative charge, and may adsorb toxins in the same way as these colloidal suspensions. The amount of toxin adsorbed depends upon the surface area of the particles. This is dependent upon the degree of fineness of the particles in suspension, or, in the case of emulsions, upon the fineness

of the oil globules. The adsorption phenomenon of these emulsions is of the reversible type. The author's principal conclusions are: Finely divided emulsions of olive oil, when mixed with superlethal doses of diphtheria toxin and injected subcutaneously, protect animals from the lethal effects of the toxin. Olive oil emulsions also protect against the lethal effects of large doses of the toxins of B. tetani, Cl. welchii and Cl. oedematis maligni (Koch). The addition of a suitable emulsifying agent to give the emulsion greater stability makes the protection against the toxins secure. Emulsions of liquid paraffin with a suitable emulsifying agent behave in a similar manner, but the cream of cow's milk affords no protection. Coarse emulsions of these oils do not exhibit this protective action.

Improved Form of Lotio Alba. Anon. *Pharm. Journ. of New Zealand,* 30 (Sept. 1, 1934). In order to compound a lotion yielding a fine suspension of zinc sulphide possessing more active properties than when otherwise prepared, recourse is had to the use of gelatin. The following formula is suggested.

A.	Sulphurated Potassa	2 drachms
	Gelatin	20 grains
	Rose Water	2 fl. ozs.

Dissolve the gelatin and then the sulphurated potassa in slightly warmed rose water and filter.

B.	Zinc Sulphate	2 drachms
	Gelatin	20 grains
	Rose Water	2 fl. ozs.

Dissolve the zinc salt in the solution of gelatin and with constant stirring, pour solution B into solution A in a fine, steady stream.

A compound lotion may be prepared by triturating one to two drachms of zinc oxide with the above, and, if preferred, improving the odor by the addition of a little spirit of camphor.

Water-Absorbing Power of Ointment Bases. Anon. *Pharm. Journ. of New Zealand,* 30 (Sept. 1, 1934). In order to provide

information concerning the absorption of water by various ointment bases, the following list has been compiled. The figures represent the maximum amount of water which can be absorbed by 100 parts of base.

Lard (with 10 per cent. petrolatum)	4
Lard (with 5 per cent. glycerin)	10
Lard	15
Lard (benzoinated)	17
Lard (with 2 per cent. resin)	22
Simple Ointment	40
Cold Cream	50
Petrolatum	10
Petrolatum (with 5 per cent. yellow wax)	65
Lanolin (hydrous)	200
Lanolin (anhydrous)	300

Controlling the Refining of Mineral Oils by Interfacial Tension Measurements. E. Vellinger and G. Radulesco. *Proc. World Petroleum Congress, 2,* 407-411 (1933). Through *Brit. Chem. Abst.* B *742* (1934). Measurements (by the du Noüy tensiometer) of the interfacial tension (T) of mineral oils against buffer solutions of varying *p*H are used to control refinery operations. The most highly refined oils show the highest T values and the curve is almost parallel to the *p*H axis, while for crude distillates the curve shows a pronounced maximum. The effects of sulphuric acid and of subsequent washing and neutralization processes have been examined, and inadequate treatment or imperfect neutralization can be detected by this method.

MEDICAL AND PHARMACEUTICAL NOTES

CINCHOPHEN AND AMIDOPYRINE DANGEROUS TO HEALTH AND LIFE—Widespread use of two dangerous drugs—one which destroys the liver and the other which kills the white corpuscles of the blood—brought a warning today from the Federal Food and Drug Administration. These drugs are cinchophen and amidopyrine. Cinchophen, a chemical anodyne and sedative, is sometimes used by sufferers from neuralgia, rheumatic pains, neuritis and similar conditions. Amidopyrine is frequently found in headache remedies and other pain killers.

"Current medical literature contains many reports which clearly indicate that these drugs are dangerous to health and life," says W. G. Campbell, chief of the Food and Drug Administration. "The gradual development of serious poisoning from the use of these drugs is often so insidious that the danger is not recognized by the user. Cinchophen causes a degeneration of the liver cells. Amidopyrine may cause a reduction in the number of white blood cells, a condition called agranulocytosis."

In issuing the warning Mr. Campbell made it plain that he was not implying that all headache and rheumatism remedies contained these dangerous drugs. But the fact that some of them do is sufficient reason for the public to be careful. Several manufacturers declare on their labels the presence of these drugs in their medicines, but others do not. There is no provision in the Food and Drugs Act to compel manufacturers to declare either of these drugs.

The Federal Food and Drugs Act requires manufacturers to declare upon the labels of their products the presence of several narcotic drugs. When the law was passed cinchophen was unknown and the dangerous effects of amidopyrine had not been recognized. For these reasons these drugs were not included in the list.

Under present conditions buyers should observe two precautions, according to Mr. Campbell. "First, read the label and look for statements of the presence of these drugs. If they are not declared and there is any doubt ask the druggist or write to the Food and Drug Administration in Washington and ask for the facts."

SILVER SICKNESS OR ARGYREMIA—Summary of article appearing in J. A. M. A., Vol. 103, No. 20, p. 1523:

1. The spectrographic demonstration of marked argyremia, or high blood silver, permitted the detection of an unsuspected and obscure case of argyria, resulting from the oral administration of silver nitrate for gastro-intestinal symptoms.

2. The blood silver was estimated spectrographically to be 0.05 mg. per hundred cubic centimeters; in normal blood, silver appears as a very faint trace or is absent, i. e., to an amount less than 0.0005 mg. per hundred cubic centimeters.

3. The persistence of the high blood silver for more than three months after exposure indicated a heavy deposition of silver in the tissues.

4. Abnormally, high silver was also detected in the urine, feces, cerebrospinal fluid, skin, dental tartar and probably saliva. The presence of the metal in the urine and feces demonstrated that silver was being partially eliminated from the body.

5. Only faint traces of silver were present in the blood and urine in definitely pigmented cases of argyria ten years or more after exposure; this showed the eventual departure of appreciable silver from the circulation.

6. The spectrographic determination of silver in the blood, skin and other parts of the body is an aid in diagnosing obscure argyria and in differentiating it from lead or bismuth intoxication.

7. The spectrographic determination of blood silver is suggested as a method of guarding against argyria in silver therapy.

8. A warning note is again sounded on the danger of internal silver therapy.

"SUPER CAUSTIC" STRONGER THAN LYE NOW AVAILABLE—Enter sodium monoxide, new super-chemical of American industry. Experts of the Niagara district, long accustomed to wresting queer substances from common minerals by the aid of electricity, now offer one of the most powerful forms of soda known to science.

Sodium monoxide, rarely prepared as an academic curiosity by a few inquisitive professors, proves to be readily available as an intermediate in peroxide manufacture. Known also simply as sodium oxide, it is described as a "super-caustic" which exceeds even caustic lye in chemical vigor. In the form of a dry powder it acts first as a powerful desiccant, or artificial drying agent. It virtually tears water

out of most organic matter, and is thereby transformed into highly concentrated lye, or sodium hydroxide. This de-watering process is attended with production of heat. As a result the normal action of the lye is accentuated, and speedy chemical action assured.

HOME, SWEET HOME—BUT WHERE IS IT?—"What are they getting at, these hired men of Science?

"Today they build and tomorrow they tear down and there is no end to their extravagances.

"These superfeature cinema cosmoses without a beginning, a middle or an end. These rococo astral Great White Ways. These glittering galaxies, watch-shaped but with no pointing hands to tell a standard celestial time. These contracting, expanding, exploding, collapsing universes, now a million times older, now a thousand times younger than this errant planet particle, the earth.

"Out come the builders. In go the wreckers. One follows modestly behind. All one wants is a few unregarded scraps with which to build a rude shelter of one's own. It is hard not to have a homeplace."—Anonymous Writer in "The Descent of the Atom" (Lothrop, Lee and Shepard).

'TWAS EVER THUS—"There is, in this City, a certain fraternity of chemical operators, who work underground, in holes, caverns and dark retirements, to conceal their mysteries from the eyes and observations of mankind. These subterranean philosophers are daily employed in the transmutation of liquors and of the power of magical drugs and incantations, are raising under the streets of London the choicest products of the hills and vales of France.

"They can squeeze Bordeaux out of a sloe and can draw Champagne from an apple. Virgil, in that remarkable prophecy—

" 'Incultisque rubens pendebit sentibus uva,'

" 'The ripening grape shall hang on every thorn' . . . seems to have hinted at this art, which can turn a plantation of northern thorn hedges into a vineyard. These adepts are known among one another by the name of *Near-brewers,* and I am afraid, do great injury, not only to their Majesty's customs, but to the bodies of many of her good subjects."—(The Tatler, A. D. 1797, Vol. viii, p. 110.)

SOLID EXTRACTS

It is recorded that in two years, 1930-1932, the sales of that sleep-inducing drug, pheno-barbital, rose in this country from 25,000 to 45,000 pounds a year. More than likely the flow of one such drug means the ebb of another, yet these figures are startling evidence of the growth of a national insomnia—particularly when we recall that there are many such drugs available—to all who seek them.

America. tossing on its feathed bed, is a bad enough admission, but a drug-depressed population is a much more serious problem.

Hail the forensic chemist! He can now tell, by estimating the salt content of the heart chambers, that a lifeless body found floating on the sea died as a result of drowning in salt water, and that a body found floating on the surface of a mountain lake died of fresh-water poisoning.

And this is how he does it. The circulating blood of all people contains a definite amount of salt. Therefore, the salt content of the blood of the left heart chamber and the right heart chamber is the same. When people drown in salt water, the salt-containing water not only reaches the lungs but circulates as far as the left heart chamber and therefore increases the salt content of the blood therein. The person, however, dies long before the circulation may carry the salt water to the right heart chamber.

Therefore in all salt water drownings the salt content of the left heart chamber is always much higher than that of the right heart chamber. In normal deaths, not drowning, the salt content of both heart chambers is the same.

In fresh water drownings water only reaches the left heart chamber and therefore dilutes the salt content. In these fresh water drownings, therefore, the blood of the right heart chamber is always more in salt content than the left heart chamber.

Ultra-violet light of sufficient intensity will destroy the poisonous venom of deadly snakes and vipers when it is contained in a test tube, but a test animal inoculated with the venom will promptly die, no matter how much ultra-violet radiation is directed against it.

"Eat the crust—discard the dough"—such has been the admonition of dietetic experts to persons allegedly suffering from carbohydrate indigestion. Now they must reverse themselves, for the findings of scientists operating at the University of California insist that the crust is the least digestible part of the loaf—and that the crumb is easiest on the gastric equipment.

A Science squib announces this remarkable discovery—"The remote ancestor of the modern dog first made its appearance about 50,000,000 years ago, in the oligocene period. The dog of that day was about the size of a California ground squirrel. From this it gradually evolved through the ages into its present-day form."

To which we react that the incertitude of the statement bothers us considerably. In the first place, how big is a California ground squirrel?—and then, too, does one establish the present-day form of a dog on the poodle basis or will an Airedale do?

When the disappointed Crusaders returned to England they brought with them the seed of the horrible Black Plague. In 1348 one-half the population of England succumbed to its dreadful ravages. Three out of every ten afflicted died—which makes the then population of the tight little isle about fourteen million—and which means that under similar circumstances, and such is not beyond the pale of possibility, the plague death total in this country over a similar period would not be far from twenty million.

We have been told of the enterprising but not careful resort pharmacist who dispensed many jars of a tannic acid containing cream allegedly valuable in the prevention and treatment of sunburn—but who was more than happy when the summer season ended and sent home to the hills again, the irate customers whose tannin-treated skin turned black as ink with iron.

"*Anstie's* Rule," as to the quantity of alcohol a man with sound organs can consume every twenty-four hours without harm, was generally accepted in several countries for decades after its establishment by Dr. F. E. Anstie, of England, about 1870. This limit, which is one and a half ounces of pure alcohol, and which, obviously, must be diluted and spread over a period of drinking time, is found in five glasses of beer of ordinary strength, or two wine glasses of fortified wine or two good drinks of whisky, gin, rum or brandy.

BOOK REVIEWS

ORGANIC CHEMISTRY. By Joseph S. Chamberlain, Ph. D., Professor of Organic Chemistry at Massachusetts State College. Third edition, revised. P. Blakiston's Son & Co., Inc., 1012 Walnut Street, Philadelphia, Pa., 1934. 873 pages. Price $4.00.

In revising this well-known work the author has undertaken the problem of condensing, by almost 200 pages, the material that ordinarily should be covered in a college course in organic chemistry.

In order to do this without actually discarding considerable material a "Supplementary Topic" section (Part III) has been added, in which are included the following subjects heretofore considered in the other parts of the book: Petroleum, Industrial Sugar and Cellulose, Amino Acids and the Constitution of Proteins, Coal Tar, Reactions of Di-azo Compounds, Dyes, Terpenes, Uric Acid and Alkaloids. It is the hope of the author that this will enable teachers to adapt the text to class use by restricting the portion actually covered to the first two parts, using the supplementary topics for additional study when possible or desirable.

Part I (366 pages) is devoted to the study of acyclic compounds, Part II (260 pages) deals with cyclic organic substances, while Part III (174 pages) contains the supplementary topics enumerated previously. Appendix I (15 pages) contains a resume of the separation, purification, identification, analysis and determination of the molecular weight of organic compounds and Appendix II (24 pages) gives a list of laboratory manuals in which specific directions may be found for the preparation of the various compounds discussed in Chamberlain's work.

Much valuable information is listed in seventeen tables inserted throughout the book. Typical tables include the chemical and physical properties of fats and their constituent acids, the reactions of carbohydrates, the reactions of diazo compounds (a four-page table), and a summary of the source and chief constituents of volatile oils.

In the present revision certain changes have been introduced in order to agree with modern electronic theories and with the latest researches in the field of carbohydrate chemistry. The chemical and physical conditions under which reactions take place have also been added, where previously omitted.

The book can be highly recommended as a text to be used in teaching organic chemistry as well as a reference book for the scientific worker who has occasion to review and consolidate his knowledge of organic chemistry.

ARTHUR OSOL.

GOULD'S POCKET MEDICAL DICTIONARY. Revised by C. V. Brownlow. Tenth Revised Edition. P. Blakiston's Son & Co., Inc., 1012 Walnut Street, Philadelphia, Pa., 1934. Price $2.00.

This work is published to meet the need for a small dictionary that can be used as a *vade mecum* for those interested in the medical sciences. It defines over 40,000 of the principal words used in medicine and the collateral sciences and contains an appendix in which are included tables of arteries, bones, muscles, nerves, microorganisms, chemical elements, signs, symbols and abbreviations used in medicine, doses of drugs for humans and animals, incompatibilities and weights and measures.

Features of the tenth edition are the new names which have been added, and three new tables of bacteria, metazoa and protozoa compiled by Dr. D. H. Bergey. To make it easier for reference, those tables (arteries, bones, etc.) which heretofore broke up the continuity of the vocabulary are now assembled in alphabetical order in the appendix.

This edition, which is also the sixty-eighth printing of this work, should be included in the library of every physician and pharmacist.

ARTHUR OSOL.

WELLCOME RESEARCH INSTITUTION, LONDON, ENGLAND. *Exhibits at the Chicago Exposition.*

Under the foregoing title the Wellcome Foundation, Ltd., has issued a de luxe publication in the shape of a small cloth bound book, beautifully printed and illustrated. In this book are briefly described the Wellcome Research Institution, the Wellcome Bureau of Scientific Research, the Wellcome Entomological Field Laboratories, the Wellcome Physiological Research Laboratories, the Wellcome Chemical Research Laboratories, the Wellcome Museum of Medical Science, and the Wellcome Historical Medical Museum. A large volume could be devoted to each of these subheadings alone,

for all but the first of these separate units have been functioning efficiently for many years, and the world in general, and the fields of surgery, medicine and pharmacy in particular have benefited incalculably by the specific results which have been achieved in each of these fields, a total of nearly one thousand research articles having been published during the lifetime of these several units. Sir Henry Wellcome has been a benefactor to mankind and the research institution which bears his name will carry to future generations the name of a great man and a great work.

C. H. L.

SCHEMA ZUR MIKROCHEMISCHEN IDENTIFIKATION VON ALKALOIDEN. F. Amelink. Translated into the German by Marga Laur. Cloth, 203 pp. and six tables. D. B. Centen's Uitgevers Maatschappij, Amsterdam, 1934.

Many microchemical reactions for the alkaloids have been recorded in the literature, but Dr. Amelink appears to be the first to describe a definite scheme for their identification. Using only eight reagents, he has developed characteristic microchemical reactions for ninety-five alkaloids and related compounds. The book is an outgrowth of the author's doctorate dissertation published in 1928. Since that time, additional investigations have made it possible to include the newest synthetic alkaloids in the present volume.

After a foreword by Professor Schoorl of the University of Utrecht, the introduction describes the technic used in conducting the reactions under the microscope. Then follows a description of the reagents: platinic chloride, gold chloride, mercuric chloride, potassium ferrocyanide, potassium ferricyanide, Dragendorff's reagent (K_3BiI_6), potassium hydroxide, and picrolonic acid (Dinitromethylphenylpyrazolone). The next chapter takes up the behavior of each alkaloid with these reagents. In addition to the alkaloids, there are included in this chapter acetanilide, antipyrine, novocaine, phenacetine, pyramidone and the like. The fifth chapter gives procedures for identifying seven powdered drugs. The text closes with a bibliography of 102 references.

In the appendix to the book, there are about 270 well-executed crystal sketches which illustrate the reaction products. Following this are tables in which the alkaloids are arranged in alphabetical

order, showing the characteristic reactions with reference to the crystal sketches. There is also a table of melting points.

The procedures described in the book have been employed successfully in university and commercial laboratories in Europe. They should likewise prove useful to those in this country who have found the microscope an invaluable tool where economy of time and material are especially desirable.

L. WILSON GREENE.

BIBULOUS WEEDS—(U. S. D. A.) Ordinarily the farmer can afford to tolerate such weeds as may grow on the uncultivated premises of his farm. Under certain conditions, however, such growth becomes quite costly. According to O. V. Stout, of the Bureau of Agricultural Engineering, weeds and water-loving plants in irrigated regions of the West use more water in proportion to the ground they occupy than do the common run of crops. Farmers in the arid region pay for water to irrigate crops and unless they eradicate water-absorbing weeds they also pay for water to grow them.

Cattails and bulrushes will consume, acre for acre, four times as much water as average crops. An acre of heavy stand of smartweed may consume in a season's growth enough water for the irrigation of three acres of alfalfa. Kelp, dock, western goldenrod, prickly lettuce, cocklebur and nettle may use twice as much water as alfalfa. —*C.* (*Jour. F. I.*).